# CITY OF LODI

# COUNCIL COMMUNICATION

AGENDA TITLE: Purchase of White Slough Aeration Diffusers ($75,000)

MEETING DATE: November 17, 1999

PREPARED BY: Public Works Director

RECOMMENDED ACTION: That the City Council adopt the attached resolution authorizing the purchase of EnviroQuip diffusers for the White Slough Water Pollution Control Facility (WSWPCF) from MISCO, of Pleasanton, in the amount of $74,800.05, and appropriate funds in accordance with the recommendation shown below.

BACKGROUND INFORMATION: This project consists of replacing 1,560 aeration diffusers at the WSWPCF. The current 24-inch diffusers will be replaced with 39-inch diffusers to increase airflow and transfer efficiency. As flows have increased, additional air is needed to maintain complete nitrification in the aeration system. The inability to nitrify will result in a violation of discharge requirements. The attached report from West Yost & Associates details their evaluation of the aeration process and recommendation for the longer diffusers.

Staff recommends the purchase of the EnviroQuip diffusers from MISCO, the sole supplier in Northern California. Our consultant's report shows the EnviroQuip has better efficiency than a similar-type diffuser. Staff's experience with the EnviroQuip has shown they are also more durable. City staff will install the diffusers in December or January.

The funds for this project were not included in the current Capital Improvement Budget since at the time of budget preparation this solution was not known. Therefore, it is our intent to defer projects currently funded and use those funds at this time. The specific items to be deferred will be re-budgeted in a future Capital Budget.

FUNDING: 1999/2000 Wastewater Capital Improvement Budget
Project Estimate: $75,000.00

Funding Available: Vicky McArthur
Finance Director

Richard Prima
Richard C. Prima, Jr.
Public Works Director

Prepared by Del Kerlin, Assistant Wastewater Treatment Superintendent

RCP/DK/tj

Attachments

cc: City Attorney
Purchasing Officer
Water/Wastewater Superintendent
Assistant Wastewater Treatment Superintendent

APPROVED: James Kerlin for
H. Dixon Flynn -- City Manager

W E S T
Y O S T
& ASSOCIATES
Consulting Engineers

October 21, 1999

Mr. Richard Prima, Public Works Director
City of Lodi
PO Box 3006
Lodi CA 95241-1910

Project No.: 213-99-01.10

SUBJECT: Interim Aeration System Improvements

Dear Richard:

We have been asked to provide recommendations for interim improvements which could allow the wastewater treatment plant to achieve full nitrification during the winter months, something which has become very difficult during the last few years. Attached is our analysis and recommendations. It would be advisable to complete the proposed modifications as soon as possible so that the increased capacity would be available this upcoming winter. If you have any questions or need additional information, please give me a call.

Very truly yours,

WEST YOST & ASSOCIATES

Robert A. Beggs

RAB:kjb

attachment

cc: Fran Forkas—City of Lodi
Del Kerlin—City of Lodi
Max Burchette—Whitley-Burchette

1260 Lake Boulevard, Suite 240 Davis, California 95616 Phone 530 756-5905 Fax 530 756-5991 e-mail: mail@westyost.com

## Attachment 1. Summary Report

# INTERIM AERATION SYSTEM IMPROVEMENTS

The purpose of this summary is to provide recommendations for immediate improvements to the aeration basins to increase oxygen transfer capacity and performance.

### EXISTING AERATION BASIN FACILITIES

Secondary treatment is provided through an aerobic suspended-growth biological system consisting of four aeration basins and two secondary clarifiers. The aeration basin wastewater flow order is from Basin 4 to Basin 3 to Basin 2 to Basin 1. The air supply provides the required oxygen for biological growth and keeps the aeration basins mixed. The purpose of the aeration basins is to convert organic wastes into biological cell mass, which can later be settled out of the water in the secondary clarifiers. Nitrification is required to remove ammonia when effluent is being discharged to prevent ammonia toxicity in fish and other aquatic life. Nitrification of ammonia to nitrate nitrogen requires a greater concentration of active treatment organisms in the aeration basins and more oxygen than a system operated for only carbonaceous material removal.

Aeration is currently provided by three 150-horsepower blowers through medium-fine bubble diffusers which produce small bubbles in the bottom of four aeration basins. There are 600 diffusers per basin for a total of 2,400 diffusers. The original 24-inch Wyss diffusers in the first three aeration basins (4,3,2) have been retrofitted with FlexLine fine bubble diffuser membranes by EnviroQuip. New flexible membranes were fitted over the old Wyss diffuser bodies. The FlexLine diffuser membranes have a higher efficiency and are considered to be more durable than the original diffuser membranes. Figure 1 is a photo of Basin 3 showing the air diffuser system.

The first aeration basin (#4) is currently operated with the air supply turned off in the first 40 percent of the basin. The purpose of this is to create an anaerobic zone which favors the growth of bacterial populations with improved settleability. Better settling in the clarifiers improves the effluent quality.

### IMPROVEMENTS NEEDED

The City of Lodi (City) wastewater treatment system was not designed for nitrification and does not appear to have capacity for nitrification treatment at flows over approximately six million gallons per day (mgd). Several improvements are needed to increase nitrification treatment capacity. Additional aeration basins and blowers will be needed to fully nitrify through the Master Planning Period of 2020. In the meantime, the current aeration system is unable to maintain dissolved oxygen levels throughout the first two or three aeration basins when operated for nitrification during winter months. As a result, the existing aeration system is in need of immediate improvements.

The existing diffusers are evenly distributed between four basins. As a rule, the first half of the aeration basins in a series configuration such as Lodi's requires 60 to 65 percent of the total oxygen demand. The total air requirement is probably even slightly higher because oxygen

# City of Lodi
# Water Pollution Control Plant

**Figure 1**

**Aeration Basin No. 3**

**Retrofitted on August 16, 1995**

transfer efficiencies are lower in dirty wastewater and improve as the water is treated. Meeting this higher air demand in the first basins may be accomplished by changing the air flow to each basin.

Increasing the airflow to a particular basin is only possible where sufficient diffusers are in place to accommodate the increased air flow. Pushing more air through an individual diffuser than its design capacity increases bubble size and can actually decrease oxygen transfer efficiency. Thus, the system works harder and produces little or no improvement in treatment performance. Therefore, the diffusers in the aeration basins need to have sufficient design capacity for increased airflow.

Figure 2 shows the estimated performance of alternative diffusers. These curves are approximate estimates of performance based on manufacturer's data and assumed operating conditions. The original Wyss diffuser performance is shown in red. The existing diffusers are represented by the next higher line referred to as EQ-24 for 24-inch EnviroQuip diffusers. The figure also shows performance of different length EnviroQuip diffusers.

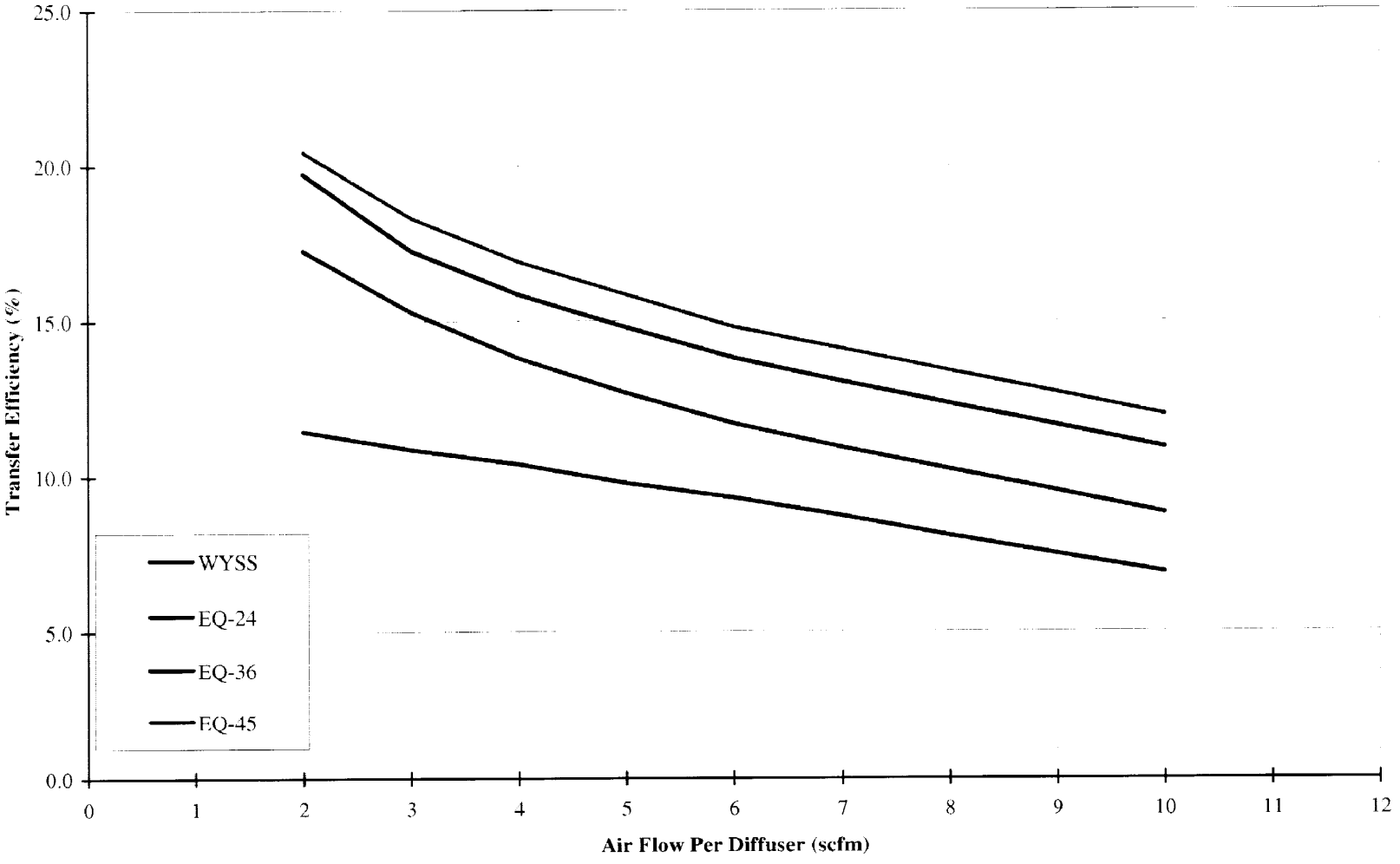
Based on a review of the aeration requirements of the existing operation, it appears that the diffusers at Lodi are inadequate to provide the required distribution of air. The major deficiency is related to the diffuser system and not blower capacity, which is adequate for most existing operating conditions. The recommended action is to replace at least 1,560 existing 24-inch diffusers in Aeration Basins 4 through 2 with 36-inch diffusers. This will effectively increase the diffuser area by 50 percent with a corresponding increase in oxygen transfer efficiency of around 20 percent. The larger diffusers may also allow slightly more total system airflow than is currently achievable. The larger diffusers can still operate with air flows as low as 3 cfm each, enabling sufficient turn-down capacity for periods of lower oxygen demand.

The existing diffuser bodies cannot be used with longer membranes. Therefore, the entire diffuser must be replaced. Use of diffuser bodies beyond 36-inch will increase the transfer efficiency further, but the gains are not as significant as going from 24-inch to 36-inch diffusers. Also, the additional stress at the attachment to the air piping imposed by a longer diffuser body increases the chance of diffuser failure. Therefore, the diffuser length should be limited to 36-inch.

Because the first 40 percent of the first aeration basin is normally not aerated, the recommended plan is to replace 360 diffusers in the first aeration basin (#4), 600 diffusers in the second basin (#3), and 600 diffusers in the third aeration basin (#2) for a total of 1,560 diffusers. The cost of 1,560 new diffusers including new diffuser bodies with new membranes, not including installation, is estimated at about $75,000. Most of the installation labor may be provided by City staff. If funds are available, it could be logistically simpler to also change out the first 240 diffusers in Basin 4 while it is out of service for modifications.

The operation of the first aeration basin could also be modified to improve aeration capacity and treatment performance. During off-peak hours, all or a portion of the existing diffusers in the first portion of the first aeration basin (#4) could be operated at low pressure to improve mixing without causing aerobic conditions. During peak diurnal loading conditions, the diffusers in the first portion of the first aeration basin could be operated at full design air pressure to provide

**Figure 2. Estimated Dirty Water Transfer Efficiencies**



additional overall aeration capacity. The operation of these diffusers at full capacity for a few hours during peak conditions would probably not upset the overall makeup and settleability characteristics of the bacterial population.

The proposed changes in diffusers and in operation of the first aeration basin may increase average oxygen transfer capacity by approximately 10 to 15 percent and peak hour oxygen transfer capacity by 15 to 20 percent. Recent improvements at the City of Vacaville's Easterly Wastewater Treatment Plant very similar to the proposed improvements for Lodi have been very successful. These proposed improvements are not sufficient for full nitrification at the Master Plan design flow of 8.5 mgd ADWF because of both oxygen transfer capacity limitations and solids concentration limitations. The improvements may allow the treatment plant to achieve full nitrification for approximately the next five years. Improvements needed to meet the Year 2020 Master Plan design criteria will be presented in the Master Plan Report.

The recommended diffusers should have a life of slightly over five years, or approximately the same duration as the window of remaining capacity in the aeration basins. When new aeration basins are designed, the most suitable air diffusion technology at that time will be selected for the existing and proposed new aeration basins.

## SUMMARY OF RECOMMENDED ACTIONS

Recommendations for interim improvements associated with the aeration are summarized below:

- Replace at least 1,560 24-inch diffusers with 36-inch diffusers. If funds are available, also replace the first 240 24-inch diffusers in Basin 4.

- Replace the diffuser membranes in the last aeration basin (#1) with the new 24-inch membranes on hand at the treatment plant.

- Direct 65 to 70 percent of the total air supply through the initial aeration basins where the 36-inch diffusers are installed. Direct 20 to 25 percent of the total air supply through the next quarter of the aeration basins. Direct 10 to 15 percent of the total air supply through the last quarter of the aeration basins.

- Operate all or a portion of the diffusers in the first half of the first aeration basin at low pressure to improve mixing during non-peak hours.

- Operate all of the diffusers in the first half of the first aeration basin at full capacity during peak diurnal conditions.

W E S T
Y O S T
& ASSOCIATES
Consulting Engineers

# MEMORANDUM

DATE: November 2, 1999

Project No.: 213-99-01.08

TO: Richard Prima
City of Lodi

CC: Del Kerlin—City of Lodi
Fran Forkas—City of Lodi

FROM: Rob Beggs

SUBJECT: Aeration Diffusers

We have been informed that the availability of 39-inch EnviroQuip diffusers is much better than the 36-inch diffusers which we recommended in our summary report dated October 21, 1999. The main advantage of 39-inch diffusers would be a slightly higher oxygen transfer efficiency than for the 36-inch diffusers can provide. A possible disadvantage of 39-inch diffusers is slightly greater physical stress on the mounting fittings. Factory representatives have stated that either size should be satisfactory for the fittings that the City has, so we would not anticipate any substantial physical problems using the 39 inch diffusers. The existing air supply system capacity should be adequate for the 39-inch diffusers. Therefore, the 39-inch diffusers may be substituted for the 36-inch diffusers if that would allow for a more timely installation.

RAB:snw

213\m

1260 Lake Boulevard, Suite 240 Davis, California 95616 Phone 530 756-5905 Fax 530 756-5991 e-mail: mail@westyost.com

RESOLUTION NO. 99-182

A RESOLUTION OF THE LODI CITY COUNCIL AUTHORIZING THE PURCHASE OF ENVIROQUIP DIFFUSERS FOR THE WHITE SLOUGH WATER POLLUTION CONTROL FACILITY, AND APPROPRIATING FUNDS TO COVER THIS PROJECT

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WHEREAS, Lodi Municipal Code, §3.20.070, authorizes dispensing with bids for purchases of supplies, services or equipment when it is in the best interest of the City to do so; and

WHEREAS, flows at the White Slough Water Pollution Control Facility have increased, and additional air is needed to maintain complete nitrification in the aeration system. The inability to nitrify will result in a violation of discharge requirements; and

WHEREAS, an evaluation of the aeration process has been performed by West Yost & Associates and have recommended using longer diffusers; and

WHEREAS, this project would consist of replacing 1,560 24-inch aeration diffusers with 39-inch diffusers to increase airflow and transfer efficiency; and

WHEREAS, staff recommends purchasing the EnviroQuip diffusers from MISCO, the sole supplier in Northern California.

NOW, THEREFORE, BE IT RESOLVED that the Lodi City Council hereby approves the sole-source purchase of 1,560 39-inch diffusers from MISCO of Pleasanton, California in the amount of $74,800.05; and

BE IT FURTHER RESOLVED, that $75,000.00 be appropriated from the 1999/2000 Wastewater Capital Improvement Budget for this project.

Dated: November 17, 1999

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I hereby certify that Resolution No. 99-182 was passed and adopted by the City Council of the City of Lodi in a regular meeting held November 17, 1999, by the following vote:

AYES: COUNCIL MEMBERS – Hitchcock, Mann, Nakanishi, Pennino and Land (Mayor)

NOES: COUNCIL MEMBERS – None

ABSENT: COUNCIL MEMBERS – None

ABSTAIN: COUNCIL MEMBERS – None

Alice M. Reimche

ALICE M. REIMCHE
City Clerk